



AMENDMENTS TO THE CLAIMS:

1. [Currently Amended] A cracking heater comprising:  
  
an enclosed housing comprising a substantially parallel front and back, a pair of  
  
substantially parallel sides, which are perpendicular to the front and back  
  
and a top and bottom providing a continuous enclosure;  
  
at least one heat source;  
  
an exhaust duct; and  
  
a tube bundle comprising a plurality of continuous horizontal tubes parallel to the  
  
pair of sides, the horizontal tubes sequentially linked together by a  
  
plurality of tube bends and where at least a portion of the tubes are  
  
arranged in a plurality of vertical columns and are horizontally and  
  
vertically offset from one another, wherein a feedstock is carried through  
  
the tubes beginning at a first end of the tube bundle and exiting at a second  
  
end of the tube bundle.
2. [Original] The cracking heater of claim 1 where at least one heat source is  
  
located on each side of the tube bundle between the tube bundle and the  
  
respective side.
3. [Original] The cracking heater of claim 1 where the tubes have a nominal  
  
radius and where the tube bends have a radius of greater than twice the  
  
nominal radius.
4. [Original] The cracking heater of claim 1 where the feedstock is carried  
  
through the tubes beginning at the top of the tube bundle and exiting at the  
  
bottom of the tube bundle.

5. [Original] The cracking heater of claim 1 where in the portion of the tubes in the plurality of vertical columns, an angle **C** is formed between the center of one tube as the vertex extending to the two closest tubes in the vertical column adjacent the tube, where the angle **C** is less than  $180^{\circ}$ .
6. [Original] The cracking heater of claim 5 where within each vertical column adjacent tubes are separated by a distance **B**, and within each pair of tubes linked by a tube bend there is a distance **E** separating the tubes in the direction of the tube bend, where **E** is greater than or equal to **B**.
7. [Original] The cracking heater of claim 5 where for all tubes in the portion of the tubes in the plurality of vertical columns, the angle **C** is less than  $180^{\circ}$ .
8. [Original] The cracking heater of claim 5 where the angle **C** is between about  $80^{\circ}$  and  $40^{\circ}$ .
9. [Original] The cracking heater of claim 1 where the cracking heater is a coking furnace and where the portion of the tubes in the plurality of vertical columns resides in a radiant heating section of the coking furnace.
10. [Currently Amended] A cracking heater comprising:
  - an enclosed housing comprising a substantially parallel front and back, a pair of substantially parallel sides, which are perpendicular to the front and back and a top and bottom providing a continuous enclosure;
  - an exhaust duct;
  - a tube bundle comprising a plurality of continuous horizontal tubes parallel to the pair of sides each with a front end and a back end, the horizontal tubes linked together by a plurality of tube bends at the front end and the back

end and arranged in a plurality of vertical columns and horizontally and  
vertically offset from one another, wherein the feedstock is carried  
through the tubes beginning at a first end of the tube bundle and exiting at  
a second end of the tube bundle, where in the portion of the tubes I the  
plurality of vertical columns, an angle **C** is formed between the center of  
one tube as the vertex extending to the two closest tubes in the vertical  
column adjacent the tube, where the angle **C** is less than 180°; and  
at least one heat source disposed between the tube bundle and each of the sides.

11. [Original] The coking furnace of claim 10 where the tubes have a nominal radius and where the tube bends have a radius of greater than twice the nominal radius.
12. [Original] The cracking heater of claim 10 where the feedstock is carried through the tubes beginning at the top of the tube bundle and exiting at the bottom of the tube bundle.
13. [Original] The cracking heater of claim 10 where within each vertical column adjacent tubes are separated by a distance **B**, and within each pair of tubes linked by a tube bend there is distance **E** separating the tubes in the direction of the tube bend, where **E** is greater than or equal to **B**.
14. [Original] The cracking heater of claim 10 where for all tubes in the portion of the tubes in the plurality of vertical columns, the angle **C** is less than 180°.
15. [Original] The cracking heater of claim 10 where the cracking heater is a coking furnace.

16. [Original] The cracking heater of claim 10 where the cracking heater is a coking furnace and where the portion of the tubes in the plurality of vertical columns resides in a radiant heating section of the coking furnace.

17. [Original] The coking furnace of claim 10 where the portion of the tubes in the plurality of vertical columns extends the entire height of the tube bundle.

18. [Withdrawn] A process for heating a feedstock comprising:

providing a cracking heater having:

an enclosed housing comprising a substantially parallel front and back, a

pair of substantially parallel sides, which are perpendicular to the

front and back and a top and bottom providing a continuous

enclosure,

at least one heat source,

an exhaust duct, and

a tube bundle comprising a plurality of continuous horizontal tubes

parallel to the pair of sides, the horizontal tubes sequentially linked

together by a plurality of tube bends and where at least a portion of

the tubes are arranged in a plurality of vertical columns and are

horizontally offset from one another; and

carrying a feedstock through the tubes beginning at a first end of the tube bundle

and exiting at a second end of the tube bundle.

19. [Withdrawn] The process of claim 18 where carrying the feedstock through the tubes is accomplished beginning at the top of the tube bundle and exiting at the bottom of the tube bundle.

20. [Withdrawn] The process of claim 18 where in providing the cracking heater, the portion of the tubes in the plurality of vertical columns, an angle C is formed between the center of one tube as the vertex extending to the two closest tubes in the vertical column adjacent the tube, where the angle C is less than 180°.

21. [Withdrawn] The process of claim 18 further comprising maintaining the cracking heater by cleaning out coke deposited inside the tubes where the maintaining is performed at a time interval less frequently than on identical number of identical tubes in a cracking heater where all of the tubes are arranged in a single vertical column operated at identical temperature.

22. [Withdrawn] The process of claim 18 where in providing the cracking heater, the tubes have a nominal radius and where the tube bends have a radius of greater than twice the nominal radius.

23. [Withdrawn] The process of claim 18 where in providing the cracking heater, cracking heater has a height which is less than the height of a cracking heater where all of the tubes are arranged in a single vertical column.

24. [Withdrawn] The process of claim 18 where in providing the cracking heater, the heat transfer to the feedstock is more efficient as compared with the heat transfer in a cracking heater where all of the tubes are arranged in a single vertical column operated at identical temperature.

25. [Currently Amended] A delayed coking charge heater for heating a coker feedstock comprising:

a first convection section;

a second radiant section adjacent to said first convection section; said second section transmitting heat to said feedstock predominantly by radiant means;

a heating conduit in said radiant section comprising a plurality of horizontal heater tubes located in the center of the coking heater and horizontally and vertically offset from one another so as to form double vertical columns; wherein said heater tubes are sequentially linked by tube bends so as to form a tube bundle; and

a plurality of burners located on each side of said heater tubes.

26. [Previously Presented] A heater according to claim 25 wherein said heating conduit comprises a plurality of continuous and generally horizontal tubes sequentially linked together by a plurality of tube bends extending from a heater inlet at the top of said radiant section to an outlet at the bottom of said radiant section.

27. [Previously Presented] A heater according to claim 26 wherein at least a portion of said tubes are arranged in two offset vertical columns having a serpentine pattern.

28. [Previously Presented] A heater according to claim 27 wherein said heater tubes are horizontally and vertically displaced so as to have a staggered configuration.

29. [Previously Presented] A heater according to claim 25 wherein said heating conduit comprises a plurality of continuous and generally horizontal tubes sequentially linked together by a plurality of tube bends extending from an upper portion of said radiant section to outlet tubes in the lower portion of said radiant section.

30. [Previously Presented] A heater according to claim 29 wherein said plurality of continuous and generally horizontal tubes sequentially linked together by a plurality of tube bends have a serpentine pattern.

31. [Previously Presented] A heater according to claim 30 wherein said plurality of continuous and generally horizontal tubes sequentially linked together by a plurality of tube bends are horizontally and vertically displaced so as to have a staggered configuration.

32. [Previously Presented] A heater according to claim 25 wherein said burners are located in a lower portion of said radiant section on each side of the conduit, between the conduit and the side walls.

33. [Currently Amended] A delayed coking heater for heating a coking feedstock comprising:

- a first convection section;

- a second radiant section adjacent to said first convection section, said second section transmitting heat to said feedstock by radiant means;

- a feedstock heater inlet at the bottom of said radiant section;

- a heating conduit in said radiant section comprising a plurality of horizontal heater tubes where at least a portion of said heater tubes are arranged in a plurality of vertical columns and are horizontally and vertically offset from one another and where said horizontal tubes are sequentially linked by tube bends to allow flow of feedstock from the bottom to the top of said heater;

- a heater outlet at the top of said radiant section; and

a plurality of burners located in a lower portion of said radiant section on each side of said heater tubes.

34. [Previously Presented] A heater according to claim 33 further comprising a plurality of conventionally arranged single column planar tube bundles.

35. [Previously Presented] A heater according to claim 33 wherein said heating conduit comprises double vertical staggered columns.

36. [Previously Presented] A heater according to claim 35 further comprising a plurality of vertical columns.

37. [Previously Presented] A heater according to claim 33 wherein said heating conduit comprises a plurality of continuous and generally horizontal tubes sequentially linked together by a plurality of tube bends extending from a heater inlet at the bottom of said radiant section to an outlet at the top of said radiant section.

38. [Previously Presented] A heater according to claim 37 wherein at least a portion of said tubes are arranged in two offset vertical columns having a serpentine pattern.

39. [New] The cracking heater of claim 1 wherein an upper portion of the tube bundle has tube bends of varying radii.